DATA COMMUNICATIONS

Related Applications

This application is a continuation application, and claims the benefit under 35 U.S.C. §§120 of application No. 10/389,705 filed on March 17, 2003, which is hereby incorporated by reference herein.

Background of the Invention

Field of the Invention

The present invention relates to methods of, computer programs for and apparatus for control and/or observation of a device with communication capabilities by a controller device with hypertext or hypermedia communication capabilities. More particular, but not exclusively, the present invention relates to methods of, computer programs for and apparatus for control and observation of a consumer electronics device with communications capability from a mobile controller device with hypertext or hypermedia communications capability over a proximity bearer.

Description of the Related Technology

Techniques of remotely controlling consumer electronics devices, such as CD players are known. Conventional remote controllers are device-specific and factory-programmed – i.e. pre-programmed in an unchangeable way – to operate the particular device. Typically, such remote controllers will have keypads with

buttons which, when pressed, will instruct the device to perform a particular function. Often, the remote controller will communicate with the device using Infra Red Data Association (IrDA) as the bearer medium and both the controller and the device will have IrDA communications hardware and software entities – i.e. IrDA transmitters and/or receivers, and IrDA protocol stacks. Most remote controllers have a one-way communication relationship with the device they control. Thus, instructions are sent from the remote controller to the device but data is not sent from the device back to the remote controller.

Figure 1 is a schematic diagram showing the one-way flow of control data from the controller side (i.e. a remote controller) to the controlled side (i.e. the consumer electronics device) according to the prior art.

Controllers with two-way communications relationships with devices are known. For example, Sony™ have developed remote controllers which are factory-programmed for Sony™ devices but which have the capability of receiving status information from those devices and displaying it to a user on a display screen on the remote controller.

User-programmable remote controllers are also known. For example, the Philips Pronto™ and the Marantz™ RC500. Typically, user-programmable remote controllers are factory-programmed for particular devices but may be re-programmed by a user to function as remote controllers for new devices by either learning the control messages used by a device-specific factory-programmed remote controller (i.e. by pointing the factory-programmed remote controller IrDA

transmitter at an IrDA receiver of the re-programmable controller which learns the control messages parasitically as the user exercises the control options available on the factory-programmed controller), or by connecting the re-programmable controller to a computing device, such as a personal computer (PC) and downloading control programs pre-configured for the new device from the Internet.

Consumer electronics devices connected to the Internet are known. For example, microwave ovens are known which may be connected to the Internet using a modem and the public switched telephone network (PSTN) for downloading cooking settings. Also, vending machines, such as Coke™ vending machines, are known which have connection to a data network and which include a server, such as a finger daemon server, for remote interrogation by a client device also connected to the data network. This may be used by a user of the remote client device to find out whether the Coke™ machine has any cans available for vending without the user needing to physically go to the machine.

One problem with the above-described approach to controlling devices is that the controller is typically specific to a particular device or a set of particular devices and must be pre-programmed (either by the manufacturer or the user) with all the capabilities of the controlled device that the user wishes to control. Another problem with the above-described approaches to controlling devices is that the method of control is unreliable. For example, one-way remote controllers have no way of determining whether a user instruction has been properly received by the device. This is particularly the case with IrDA remote controllers which require

line of sight to the device. Furthermore, with two-way communication between remote controller and device, reliability can be even more of a problem. For example, where the remote controller maintains state relating to the operational status of the device, the unreliability of communicating commands to the device and the unreliability of receiving status from the device means that the state maintained in the remote controller may not be synchronised with the actual state of the device.

One problem with the above described approach to receiving status information at a controller device from a controlled device is that the controlled device must have knowledge of the capabilities of the controller device – for example, the display capabilities of the controller device.

Summary of Certain Inventive Aspects of the Invention

According to a first aspect of the present invention, there is provided a method of providing a remote data processing device with control data, the control data enabling a user to control the operation of a consumer electronics device, both the remote data processing device and the consumer electronics device being capable of communication using a hypermedia data communications protocol, the method comprising the following steps:

a) the consumer electronics device generating a hypermedia data message, the hypermedia data message comprising data representing one or more menu options, the menu options corresponding to one or more actions capable of

being performed by the consumer electronics device in response to receiving a control message corresponding to one or more of the menu options;

b) the consumer electronics device sending the hypermedia data message to the remote data processing device using the hypermedia data communications protocol.

According to a second aspect of the present invention, there is provided a method of providing a remote data processing device with data representing the operational state of a consumer electronics device, both the remote data processing device and the consumer electronics device being capable of communication using a hypermedia data communications protocol, the method comprising the following steps:

a) the consumer electronics device generating a hypermedia data message in dependence on the operational state of the consumer electronics device; and

b) sending the hypermedia data message to the remote data processing device using the hypermedia data communications protocol.

According to a third aspect of the present invention, there is provided a method of controlling a consumer electronics device using a remote data processing device, both the remote data processing device and the consumer electronics device being capable of communication using a hypermedia data communications protocol, the method comprising the following steps:

a) the consumer electronics device generating a hypermedia data message, the hypermedia data message comprising data representing one or more menu options, the menu options corresponding to one or more actions capable of being performed by the consumer electronics device in response to receiving a control message corresponding to one or more of the menu options;

b) the consumer electronics device sending the hypermedia data message to the remote data processing device using the hypermedia data communications protocol;

c) the remote data processing device presenting the one or more menu options to a user via a man-machine interface;

d) the user selecting one or more of the menu options using the man-machine interface;

e) the remote data processing device generating and sending to the consumer electronics device a control message in response to the user selection;

f) the consumer electronics device performing the corresponding action or actions in response to the received control message.

According to a fourth aspect of the present invention, there is provided a consumer electronics device adapted to provide a remote data processing device with control data, the control data enabling a user to control the operation of the consumer electronics device, the consumer electronics device being capable of communication using a hypermedia data communications protocol, the consumer electronics device comprising the following:

a) means for generating a hypermedia data message, the hypermedia data message comprising data representing one or more menu options, the menu options corresponding to one or more actions capable of being performed by the consumer electronics device in response to receiving a control message corresponding to one or more of the menu options;

b) means for sending the hypermedia data message to the remote data processing device using the hypermedia data communications protocol.

According to a fifth aspect of the present invention, there is provided a consumer electronics device adapted to provide a remote data processing device with data representing its operational state, the consumer electronics device being capable of communication using a hypermedia data communications protocol, the consumer electronics device comprising the following:

a) means for generating a hypermedia data message in dependence on its operational state; and

b) means for sending the hypermedia data message to the remote data processing device using the hypermedia data communications protocol.

According to a sixth aspect of the present invention, there is provided a consumer electronics device adapted to be controlled using a remote data processing device, the consumer electronics device being capable of communication using a hypermedia data communications protocol, the consumer electronics device comprising the following:

a) means for generating a hypermedia data message, the hypermedia data message comprising data representing one or more menu options, the menu options corresponding to one or more actions capable of being performed by the consumer electronics device in response to receiving a control message corresponding to one or more of the menu options;

b) means for sending a hypermedia data message to the remote data processing device using the hypermedia data communications protocol;

c) means for receiving a control message from the remote data processing device using the hypermedia data communications protocol;

d) means for performing one or more actions in response to a received control message.

According to a seventh aspect of the present invention, there is provided a control unit for a consumer electronics device, the control unit being adapted to provide a remote data processing device with control data, the control data enabling a user to control the operation of the consumer electronics device, the control unit comprising:

a) means for determining the operational state of the consumer electronics device;

b) means for generating a hypermedia data message, the hypermedia data message comprising data representing one or more menu options, the menu options corresponding to one or more actions capable of being performed by the consumer electronics device;

c) means for sending the hypermedia data message to the remote data processing device using a hypermedia data communications protocol.

According to an eighth aspect of the present invention, there is provided a control unit for a consumer electronics device, the control unit being adapted to provide a remote data processing device with data representing its operational state, the control unit comprising the following:

a) means for determining the operational state of the consumer electronics device;

b) means for generating a hypermedia data message in dependence on its operational state; and

c) means for sending the hypermedia data message to the remote data processing device using a hypermedia data communications protocol.

According to a ninth aspect of the present invention, there is provided a control unit for a consumer electronics device, the control unit comprising the following:

a) means for generating a hypermedia data message, the hypermedia data message comprising data representing one or more menu options, the menu options corresponding to one or more actions capable of being performed by the consumer electronics device in response to receiving one or more control messages corresponding to one or more of the menu options;

b) means for sending the hypermedia data message to a remote data processing device using a hypermedia data communications protocol;

c) means for receiving a control message from a remote data processing device;

d) means for controlling the consumer electronics device to perform one or more actions in response to a received control message.

According to a tenth aspect of the present invention, there is provided an integrated circuit for a consumer electronics device comprising:

a) communications means adapted to communicate using a proximity bearer;

b) microprocessor control unit means;

c) interface means for electronic communication with a controller of the consumer electronics device.

According to an eleventh aspect of the present invention, there is provided a data processing device comprising proximity bearer communications means and hypermedia transport protocol message generation means, wherein the device is adapted to communicate with remote data processing devices using the hypermedia transport protocol over the proximity bearer.

According to a twelfth aspect of the present invention, there is provided a method of controlling a consumer electronics device, the consumer electronics device being capable of communicating using a hypermedia data communications protocol over a proximity bearer, the method comprising the following steps:

a) the consumer electronics device receiving a hypermedia request message;

b) the consumer electronics device determining one or more actions to be performed by the consumer electronics device, the determining being performed in dependence on the hypermedia request message;

c) the consumer electronics device performing the one or more actions.

According to a thirteenth aspect of the present invention, there is provided a method of compiling a computer program into a machine code program, the computer program being written in a programming language, the programming language having native functions or methods for causing the interrogation of electronic input/output interfaces and having native functions or methods for causing the generation of menu option descriptions for inclusion in hypermedia data messages.

According to a fourteenth aspect of the present invention, there is provided a method of controlling a controlled data processing device using a controller data processing device, the controlled device and controller device both being capable of communication using a hypermedia data communications protocol, the method comprising the following steps:

a) the controlled device sending a hypermedia data message to the controller device using the hypermedia protocol, the hypermedia data message comprising one or more hyperlinks;

b) the controller device presenting the hypermedia data message to a user of the controller device using a man-machine interface of the controller device;

c) the user selecting one or more of the one or more hyperlinks using the man-machine interface;

d) in response to the user selection, the controller device sending a hypermedia request message to the controlled device using the hypermedia protocol; and

e) the controlled device performing an action in response to the hypermedia request message received.

According to a fifteenth aspect of the present invention, there is provided a method of controlling a controlled data processing device using a controller data processing device, the controlled device being capable of communication using a data communications protocol, the controller device being capable of communication using a hypermedia data communications protocol, the method comprising the following steps:

a) the controlled device sending a data message to a mediating data processing device using the data communications protocol, the mediating device being capable of communication using both the data communications protocol and the hypermedia data communications protocol,

b) in response to the data message received, the mediating device sending a hypermedia data message to the controller device using the hypermedia data communications protocol, the hypermedia message comprising one or more hyperlinks;

c) the controller device presenting the hypermedia data message to a user of the controller device using a man-machine interface of the controller device;

d) the user selecting one or more of the one or more hyperlinks using the man-machine interface;

e) in response to the user selection, the controller device sending a hypermedia request message to the mediating device using the hypermedia data communications protocol;

f) in response to the hypermedia request message received, the mediating device sending a control data message to the controlled device using the data communications protocol; and

g) the controlled device performing an action in response to the control data message received.

According to a sixteenth aspect of the present invention, there is provided a method of receiving status information from a consumer electronics device at a remote data processing device, the consumer electronics device and remote device both being capable of communication using a hypermedia data communications protocol over a proximity bearer, the method comprising the following steps:

a) the consumer electronics device sending a hypermedia data message to the remote device using the hypermedia protocol over the proximity bearer, the hypermedia data message comprising data representing the state of the consumer electronics device;

b) the remote device receiving the hypermedia data message using the hypermedia data communications protocol over the proximity bearer; and

c) the remote device presenting the hypermedia data message to a user of the remote device using a man-machine interface of the controller device.

According to a seventeenth aspect of the present invention, there is provided a method of receiving status information from a consumer electronic device at a remote data processing device, the remote data processing device being capable of communication using a hypermedia data communications protocol over a proximity bearer, the consumer electronics device being capable of communication using a data communications protocol, the method comprising the following steps:

a) the consumer electronics device sending a data message to a mediating data processing device using the data communications protocol, the mediating data processing device being capable of communication using both the data communications protocol and the hypermedia data communications protocol, data message comprising data representing the state of the consumer electronics device, the data message comprising data representing the state of the consumer electronics device;

b) in response to the data message received, the mediating device sending a hypermedia data message to the remote device using the hypermedia data communication protocol over the proximity bearer, the hypermedia data message comprising data representing the state of the consumer electronics device;

c) the remote device receiving the hypermedia data message using the hypermedia data communications protocol over the proximity bearer; and

d) the remote device presenting the hypermedia data message to a user of the remote device using a man-machine interface of the controller device.

Further aspects of the present invention are set out in the appended claims.

One advantage of the present invention is that it facilitates control and/or observation of controlled devices without the controller device needing to have any prior knowledge or expectations of the capabilities of the controlled device, save that it is capable of hypermedia communication with the controller device. Thus, the controller device need not be pre-programmed with device-specific information either by a user or manufacturer as has been the case according to the prior art described above.

Another advantage of the present invention is that the control and/or observation communication between a controller device and a controlled is reliable and any controlled device operational state maintained by the controller device will be reliably synchronised with the actual operational state of the controlled device.

Another advantage of the present invention is that the controller device need not store data enabling the control and/or observation of the controlled device permanently or for as long as required by prior art systems described above.

Another advantage of the present invention is that the controller device need not store data enabling the control and/or observation of the controlled device in a manner which are currently not valid due to the operational state of the

controlled device as required by prior art systems described above. For example, the controller device will not store data enabling the control of a controlled CD player to stop playing a CD when the CD player is not currently playing a CD.

There now follows, by way of example only, a detailed description of the present invention in which:

Brief Description of the Drawings

Figure 1 is a schematic diagram showing the flow of control data in a remote control arrangement according to the prior art;

Figure 2 is a schematic diagram showing the flow of control data in a remote control arrangement according to an embodiment of the present invention;

Figures 3a) and b) are schematic diagrams showing the system architecture of a remote controller and controlled device according to embodiments of the present invention;

Figures 4a) and b) are schematic diagrams showing interactions between a remote controller and a controlled device according to embodiments of the present invention;

Figures 5, 6 and 7 are flow diagrams showing the initial and subsequent detection procedures for establishing communications links between controlled devices and controller devices according to embodiments of the present invention;

Figures 8a) to l) show typical user interfaces presented to a user of a remote controller according to the present invention; and

Figure 9 is a circuit diagram of an control unit for a controlled device according to an embodiment the present invention.

Detailed Description of Certain Embodiments of the Invention

By way of a brief overview, the present invention (sometimes referred to as the Hypertext or Hypermedia Control System or HCS) provides a system for control and/or observation of a controlled device, such as a consumer electronics device, by a controller, such as a WAP-enabled mobile phone, in which the controller need not have any prior knowledge or expectations of the capabilities, or even the presence of the controlled device. The controller is essentially stateless and has not been programmed either by the manufacturer or the user of the controlled device. Similarly, the controlled device has no pre-configured knowledge or expectations of the controller. However, the controller and the controlled device are both able to communicate using a hypermedia protocol, such as the Hypertext Transfer Protocol (HTTP) or the Wireless Transfer Protocol (WTP). Typically, but not necessarily, the controller and the controlled device will communicate over a proximity bearer (PB) such as Bluetooth™ (BT).

Figure 2 is a schematic diagram showing the flow of control data in a remote control arrangement according to an embodiment of the present invention in which it is shown that data may flow from the controlled side to the controller side as well as from the controller side to the controlled side. Data flowing from the control side to the controller side may include data representing the operational status of the controlled device and/or data for programming the controller device to

enable it to send control data to the controlled device for controlling the controlled device.

Figure 3a) is a schematic diagram showing the system architecture of a remote controller and controlled device according to an embodiment of the present invention. Domain 1 is the hypermedia control system domain incorporating a hypermedia controller domain 10 and a device domain 20. The hypermedia controller domain may correspond to a data processing device such as a mobile phone or a personal digital assistant (PDA), or any other data processing device whether fixed or mobile. The hypermedia control domain 10 comprises a controller man-machine interface (MMI) 12 such as a screen and a keypad and a hypermedia protocol stack, proximity bearer stack and proximity bearer equipment 14. Typically, the hypermedia control domain device will operate a hypermedia application such as a Web or WAP browser application. They hypermedia control domain device may receive hypermedia data messages and send hypermedia request messages or other request messages using protocol and bearer stack 14. The device domain 20 comprises a proximity link controller (PLC) domain 22 and a device controller domain 24. The PLC domain 22 comprises a hypermedia protocol stack, proximity bearer stack and proximity bearer equipment 26 corresponding to the controller-side stack and bearer arrangement 14. The device domain is able to receive hypertext request messages or other control messages using stack and bearer arrangement 26, in particular it is able to receive such messages from the hypermedia control domain device. Messages received are

filtered using hypermedia control request filter (HCRF) 28 which filters hypermedia request messages to device hypertext control interpreter (DHCI) 30. DHCI 30 is a computer program or microcoded sub-system that interprets hypermedia requests using hypermedia control virtual machine (HCVM) 32 itself a computer program or microcoded sub-system. The combination of DHCI 30 and HCVM 32 is able to interpret hypertext request messages received as control messages for controlling the controlled device. This is achieved by passing control messages to device controller domain 24 using device bus protocol 34. Preferably, the PLC is arranged to communicate using two or more hypermedia protocols such as WAP, Web, iMode etc. so that control is possible using controller devices capable of communicating using any one of the hypermedia protocols.

Thus, a hypermedia control device is able to control a remote device, such as a consumer electronics device, using a hypertext data communications protocol over a proximity bearer. In other embodiments of the present invention, the controller device is able to control the control device using the proximity bearer alone. In other embodiments of the present invention, the controller device and the controlled device communicate using a link level communications bearer other than a proximity bearer. For example, they may communicate using physical cabling or another data communications network such as an Internet protocol network or a public switched telephone network or a cellular network.

The combination of HCVM 32 and DHCI 30 are also arranged to be capable of interrogating the device controller 24 to receive data representing the

operational status of the controlled device. Using this data, HCVM 32 and DHCI 30 are able to generate hypermedia data messages comprising data representing the operational state of the control device and sending these data messages to the controller device using the stack and bearer arrangement 26. Upon receipt of the hypermedia data messages using stack and bearer arrangement 14, the controller device is able to display the hypermedia data message to a user of the controller device using the MMI 12. For example, the controller device may display a Web page or a WAP card or deck to the user via a browser application. Thus, the control device is able to present data representing the operational state of the device to a user of a remote controller device in the form of a hypermedia data message.

Furthermore, the hypermedia data messages generated by the controlled device may include hyperlinks or other menu options which, when presented to a user of the controller device, may be selected or activated by the user thereby causing the controller device to generate a hypertext request message or other control message for sending to the control device and thereby controlling the controlled device as has been described above. These hyperlinks or menu options may represent the currently available actions that may be performed by the control device. For example, if the control device is a CD player and the CD player is currently playing a CD, then a hyperlink or menu option for stopping the CD player may be included in the hypermedia data message, but not a hyperlink or menu option for starting the CD player to play a CD.

Thus, it can be seen that the control device arrangement as shown in Figure 3a) is able to provide a controller device with both its operational status and data enabling the controller device to control the controlled device.

Figure 3b) is a schematic diagram showing the system architecture of a remote controller and control device according to an embodiment of the present invention, as described in general with reference to Figure 3a) above. Figure 3b) shows a particular embodiment in which the stack and bearer arrangements 14 and 26 are WAP over BT stack and bearer arrangements and the device bus protocol 34 and device controller 24 use the I2C protocol.

Figures 4a) and 4b) are schematic diagrams showing interactions between the remote controller and the control device according to embodiments of the present invention. Figure 4a) shows one embodiment of the present invention in which the PLC merely formats and relays hypermedia request messages received from the controller device for passing to the controller of the controlled device for obtaining status or controlling the control device. Similarly, the PLC merely formats and relays status information received from the control device as hypertext data message for sending to the controller device. Figure 4b) shows an alternative embodiment in which the PLC interprets hypermedia request messages received from the controller device using a compiled control program code specific to the controlled device and generates a control message for controlling or interrogating the controlled device. Similarly, operational status data from the controlled device is interpreted and used to generate a hypertext data message for sending to the

controller device. The compiled hypertext control language code used in the embodiment described with reference to Figure 4b) is executed by the HCVM and controls the interaction between the controller device and the controlled device. The compiled code is compiled from a source program written in a programming language which has functions or methods for interrogating a controlled device via a controller interface to obtain the operational status of the controlled device and functions and methods for issuing commands to the controlled device via a controller interface. The language also has functions or methods for causing the generation of hypertext data messages comprising data representing the operational state of the controlled device and/or comprising data enabling the controller device to control the controlled device as described above.

The compiled code is executed by the HCVM, but the HCVM does not itself have the ability to generate hypermedia data messages. This is left to the DHCI which functions as a wrapper to the HCVM and generates hypermedia data messages in response to instructions received from the HCVM. This is the case in both embodiments described with reference to Figures 4a) and 4b).

Figures 5, 6 and 7 are flow diagrams showing the initial and subsequent detection procedures operated by control devices to detect controller devices according to embodiments of the present invention. Figure 5 shows a flow diagram for initial detection of a controllable device by a controller device. The controller device is, for example, a WAP enabled mobile phone. Initially, the phone is in idle mode at step 40. Upon selection of an option to "find local devices" displayed on

the phone MMI at step 42, the phone performs detection of local PLCs at step 44. At step 46, if the phone has not detected a local PLC, the process returns to step 40. However, if the phone has detected a local PLC, the process continues to step 48 where the phone displays a selection menu on the MMI showing the one or more PLCs detected in the locality. During detection at step 44, the MMI of the phone will look like Figure 8a). At steps 48 and 50, the MMI of the phone will look like Figure 8b). For controller devices and controlled devices using BT as a proximity bearer, standard BT detection procedures are used to perform the steps described above.

Figure 6 is a flow diagram showing the process followed when the PLC of a controlled device has not previously been accessed by the controller device. Continuing from step 50, the user selects a PLC using the MMI of the phone at step 52. This generates a hypermedia request to access a "home page" of the PLC at step 54. At step 56 the PLC response to the request is pending and at step 58 the PLC, knowing that the controller device has not been registered in an access register, provides a response to the request requiring input of a personal identification number (PIN) from the user. The PLC is aware that the controller device has not previously accessed the PLC, because it maintains a controller device or user identifier, such as a BT identifier or MSISDN in an access register. At step 60, the user enters the required PIN using the MMI of the controller device and a message is passed to the controlled device providing this PIN. At step 62,

the PLC responds with the home page of the controlled device. At step 64, the PLC enters a proximity link active state.

Figure 7 is a flow diagram showing the corresponding process followed where the PLC recognises the controller device requesting access using a BT identifier or MSISDN identifier obtained from the controller device. The flow diagram is the same as for Figure 6 except that steps 58 and 60 are omitted.

Once the PLC of a controlled device has sent a hypermedia data message constituting a "home page" of the controlled device to the controller device, the user of the controller device may navigate through menu options presented on the MMI in a manner similar to navigating through a Internet Web site having first accessed the home page of the Web site. However, unlike navigating through a Web site, the actions of the user of the controller device may result in the control of the controlled device. Furthermore, the current status of the controlled device may be presented to the user of the controller device and menu options corresponding to currently available actions that may be performed by the controlled device are dynamically presented to the user of the controller device as the user navigates/controls the controlled device. Thus the controller device is being dynamically programmed to control the controlled device by the controlled device itself.

Figures 8a) to 8l) show the MMI of a controller device, i.e. the screen and keypad of a Web or WAP -enabled mobile phone as a user navigates through menu options presented to him. After selecting an option to search for local devices

using, for example, standard BT detection procedures, the mobile phone displays a message as shown in Figure 8a), indicating that the phone is searching for a PLC in the neighbourhood. Figure 8b) shows a selection menu for selecting one of three controllable devices equipped with PLCs in the neighbourhood. The user selects a Sony™ CDP-123 CD player. Figure 8c) shows a home page of the Sony™ player giving the user options to play a CD, select tracks, receive disk information or open the CD tray. No option to stop or pause the playing of the CD presented because the CD is not currently playing. The menu options are presented are hyperlinks which when selected by the user generate hypermedia request messages for sending to the controlled device.

In Figures 8a) and 8b) the screen displayed by the phone is not a displayed Web or WAP page or card, although if the phone were equipped with its own PLC functioning as a proxy for remote PLCs then a Web or WAP page or card may be displayed by the local PLC. However, Figure 8c) shows a Web or WAP page or card received from the PLC of the controlled device and presents it to the user of the phone by a browser application. Figure 8d) shows another page or card displayed by the phone. The page or card displays status information – such as the fact that track 12 is playing – and menu options corresponding to actions of the control device that may be instructed by the user. Figure 8e) shows a page or card displayed by the phone in which the user may select complex options such as the playing of a selected number of tracks of the CD. This may be achieved by using

forms or applets for capturing complex user instructions before generating a hypermedia request message for sending to the controlled device.

Figures 8f), 8g), 8h), 8k) and 8l) relate to security options which may be implemented in the present invention. If the phone has not accessed the PLC of the controlled device before, the PLC may send a PIN request page or card for presentation to the user such as shown in Figure 8g). The user enters a master code provided in documentation accompanying the controlled device and upon submission is presented with a page or card such as shown in Figure 8h) showing a user level PIN access code. If however the master code entered is invalid, the PLC sends a page or card such as shown in Figure 8f). After authentication, the PLC sends normal operational pages or cards to the phone such as shown in Figures 8i) and 8j) and such as described above with reference to Figures 8c) and 8d). Upon subsequent access by the mobile phone to the PLC of the same controllable device, an initial authentication screen such as shown in Figure 8g) is not presented. Instead, a subsequent authentication screen such as shown in Figure 8k) is presented in which the user is asked to supply a user level PIN. Upon successful entry of the PIN, the PLC proceeds to display normal operational cards or pages such as shown in Figures 8i) and 8j). Figure 8l) shows a screen for controlling user level PINs which may be accessed on supply of a master level PIN.

Figure 9 shows a circuit diagram for a control unit, which may be implemented as an integrated circuit, for use in a controlled device such as a consumer electronics device. The control unit comprises a radio frequency front

end 70 connected to a proximity bearer protocol core 80 such as a BT core. The control unit also comprises a microprocessor unit 82, random access memory 84 and read only memory 86. The hypermedia protocol stack and proximity bearer stack may be implemented in the proximity core 80. The HCRF, HCVM and DHCI may be stored in ROM 86 and/or RAM 84 and executed by microprocessor 82. Microprocessor 82 may interrogate and control the controller of the consumer electronics device via various interface means 88. These interface means include a universal serial bus (USB), an Inter Integrated Circuit Bus (I2CB), a general parallel input output bus (GPIO) and a Universal Asynchronous Receiver Transmitter (UART).

The present invention is described in further detail in a technical report document appended hereto as Appendix A.

It is to be understood that the controller devices of the present invention are not limited to mobile phones or PDAs but may be any data processing device whether fixed or mobile which is capable of hypermedia communication whether over a radio interface or over a wired data network. It is also to be understood that the controlled devices according to the present invention may be any data processing devices capable of hypermedia communication whether over a radio interface or over a wired data network. Typically, but not necessarily, the controlled device will be a consumer electronics device such as a CD player, refrigerator, etc. Throughout this document, the term hypermedia and hypertext have been used to refer to any data representation capable of comprising data

object referencing other data objects, such as text, audio or visual data etc. It is also to be understood that, while proximity bearers such as BT and IrDA have been described for providing remote communications between a controller device and a controlled device, the present invention may be implemented using a data communication bearer. For example, communication may take place over local area networks, IP networks, public switched telephone network, or cellular mobile networks such as GSM.